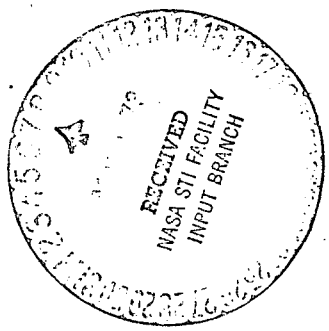

Hydrological Investigations in Norway.

Helge A. Ödegaard.

Norwegian Water Resources and Electricity Board.

Postbox 5091,

OSLO 3, NORWAY

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Name and adress of national sponsoring agency.

NTNF

Wm. Thranesgt. 98

OSLO 1, NORWAY

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15. Abstract.

Reports on the work done in Norway to establish relation ship between amount of snow and reflectivity and also determine how different degrees of soil moisture influence the reflectance.

Only two pictures have been received from part of the test area. Several wells have been established to follow the ground water level.

Basis measurements have been made to facilitate snow-taxation from low-flying aircraft based on the natural gamma radiation from the ground.

The work on our project is going well and according to plans.

Our project is to establish the relationship between the moisture (ground water and soil moisture) and the changes in the reflectivity in the space acquired data.

To get information about the ground water level-variation during the season we finished establishing a network of ground-water-wells just before the snow arrived. We have now a good network covering most of the mountaneous areas in southern Norway. The level in the wells are recorded once a week, and they all seem to function well.

See map 1 which shows the location of all wells in the southern part of Norway. This spring we plan to extend this network further and build several measuring dams in small streams. By this method we will get a good indication of the outflow from the areas - and thereby the water-content of the soil mass. This will so give us the size of the ground-water reservoir.

We feel that by working with small test catchment areas and get the information from them - we can easily extend this information to large areas.

Snow-measurements.

We have previously developed an operational system for determining the amount of snow on the ground by using natural gamma-radiation from the soil. The system is earlier established and has given good results. The radiation is rather strong in the mountains where we work, and we have no difficulties

measuring large amounts of snow.

In connection with our NASA-project this system has been further extended and is now established as shown in map no. 2.

The areas ~~is~~ were covered with an aircraft type Aztec on october 11. - 13. before the snow fell. The areas were well suited for this method with relative high background gamma-radiation. Map no. 2 shows the location of areas covered. In two places, marked A and B on map 2, radiation decreased to 25 % of the radiation of area marked C which is used as a standard. Even with a relative low level of radiation a fair amount of snow can be measured.

To follow the accumulation of snow two new flights will be made February 1 and April 1. Theese flights will be made with a twin engine Aerocommander, and the number of counters will be increased from one to two. This will make it possible to fly higher (aprox. 150 m) and faster. The work on the snow-gamma-project is done by the Norwegian Atomic Energy Institute (IFA) which now has gained a lot of experience in this special type of work.

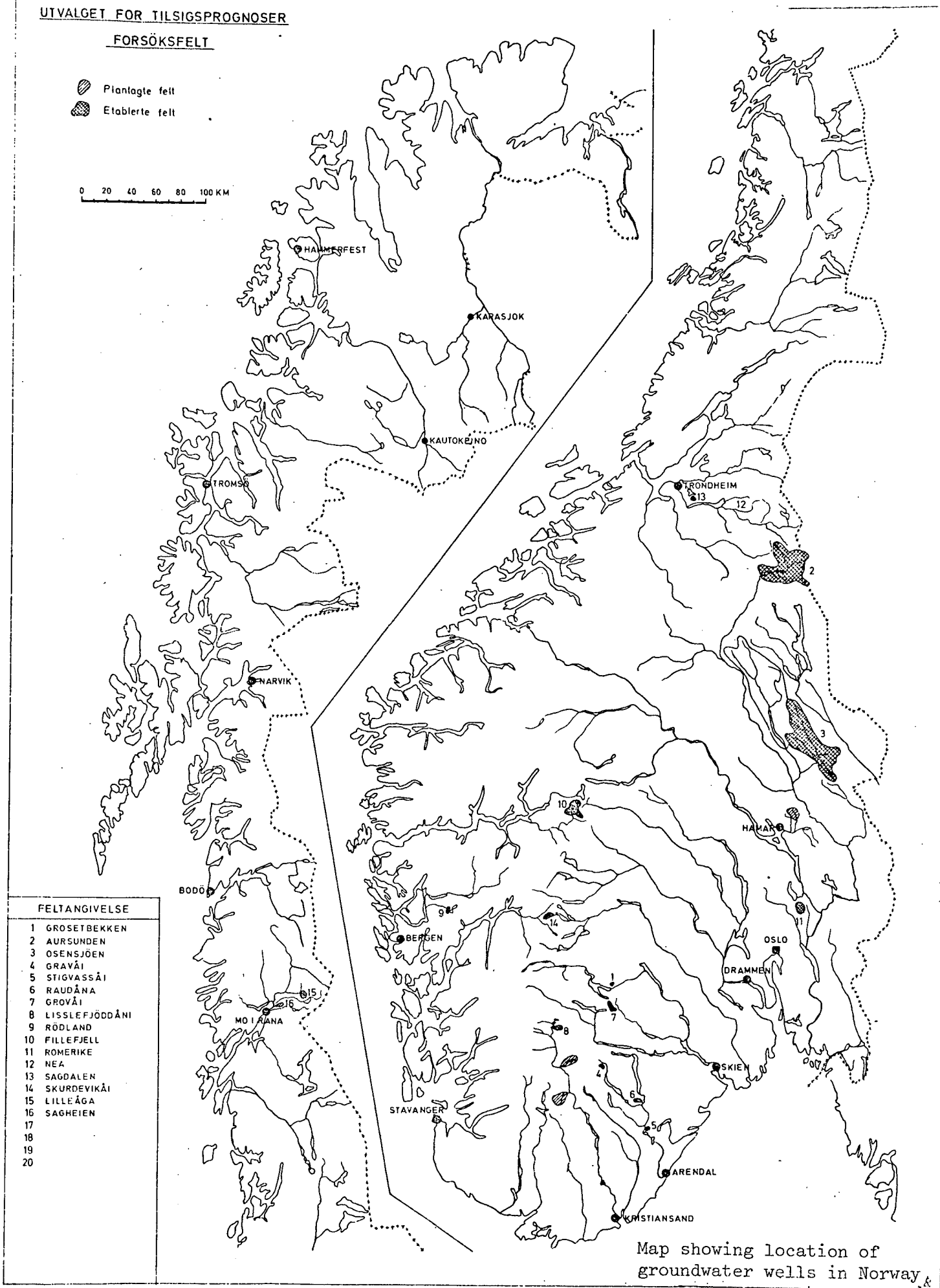
The pictures we have received covering Norway up to this date are of a very good quality. The last set of pictures from Southern Norway made on October 12, 1972, shows that valleys are filled with shadows. This shows that after this date we loose some detail in the pictures. However from calculations we see that the sun will reach the same elevation again on March 1, and we hope it will be possible to get new pictures from this date on. The picture of most interest for our project up to this date is No. 1081-10090. It shows very well the light cover of snow in the mountains. Several large reservoirs connected to hydro electric plants are shown. It is interesting to note that

the reservoir Paalsbu comes out very clearly. The water level was on October 12 lowered 5,0 metres, and there is a clearly visible light edge around the lake in picture MSS 5. This zone consist of sand and rock with no vegetation, and has a width of 30 - 50 metres. This indicate that small details are visible in the pictures.

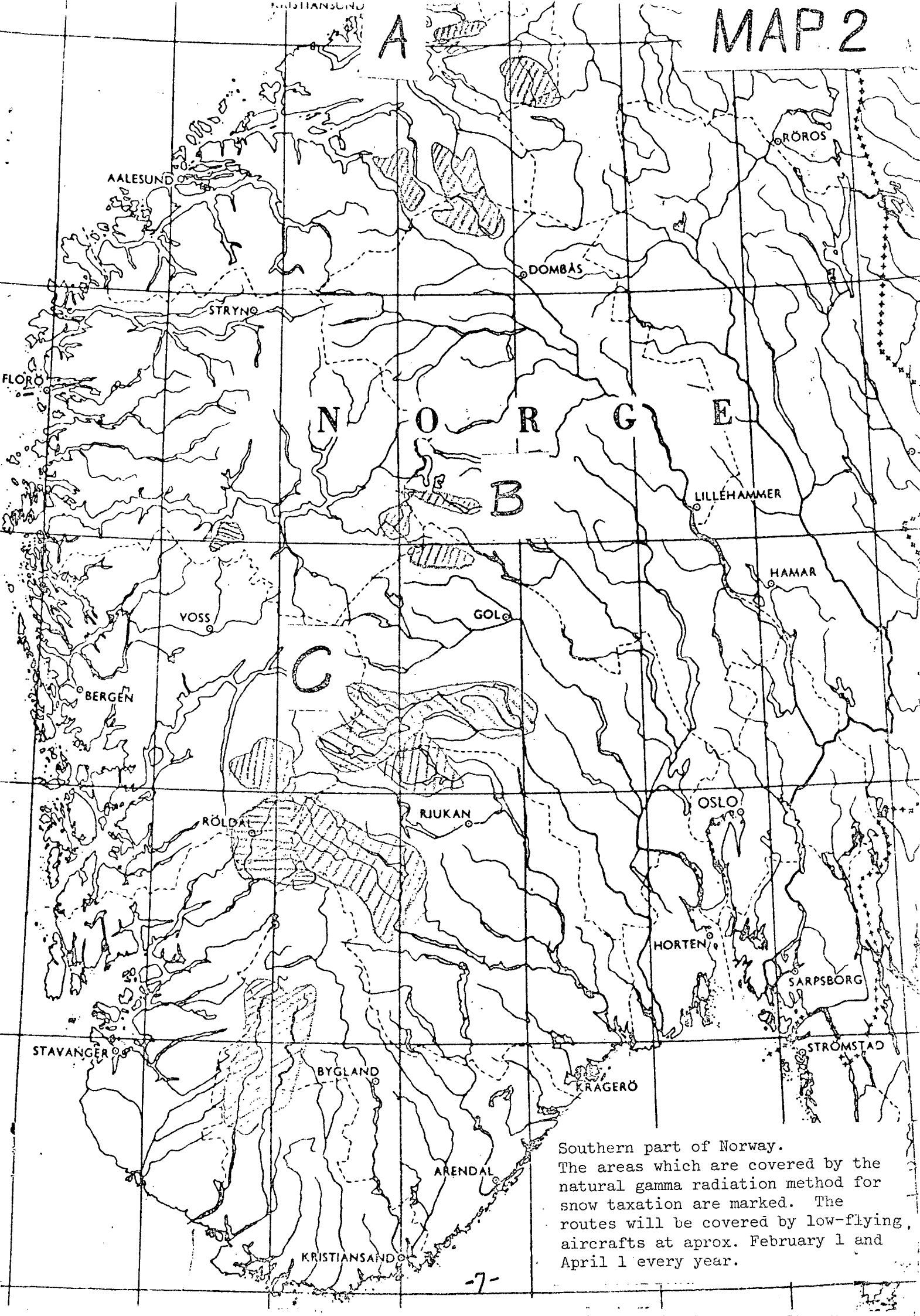
The lake Tunhovd below lake Paalsbu has a lighter tone in MSS 5. We find this very interesting but can not at this time say what the reason for this can be. There is only about 100 persons living by the lake all-year round and there is no agriculture. There is however several tunnels bringing water from nearby streams into the lake. This water can have a different temperature or chemical composition which may account for the difference. We will be working with this to find an explanation.

It is difficult to find the right places for drilling of ground-water wells to follow the ground-water levels in the mountains. At elevations above 800 metres above sea level there is no forest, only a low vegetative cover. It is very hard to determine the depth to the bed-rock, and we are looking for large sand deposits which retains the water and is the right place for a test well. We hope however that theese glacial sand deposits will be visible on space acquired data by an add-color technique.

MAP 1



Map showing location of groundwater wells in Norway.



Southern part of Norway.
The areas which are covered by the natural gamma radiation method for snow taxation are marked. The routes will be covered by low-flying aircrafts at aprox. February 1 and April 1 every year.

PRELIMINARY REPORT ON SNOWMAPPING IN ONE SELECTED AREA IN SOUTH NORWAY USING ERTS I IMAGERY

The ERTS imagery study was made on single band prints of No.1081-10090 taken on October 12. 1972. The Mår-lake area was sellected for snowmapping of early season snow accumulation.

Near this lake the snowline seems to follow the 1300 m.a.s. contour line. Further W,near Kallingsjöen-lake, the snowline is close to the 1250 m.a.s. contour line. To the N in Geitvassdalen-valley, the snow is seem in the valleybottom 1176 m.a.s.

The two lakes named Viuvatn and Steintjörni,1324 and 1342 m.a.s. situated between Kallingsjöen and Geitvassdalen, have a higher albedo than the nearbye lakes at a bit lower level. This can be explained by asuming that these two lakes are covered by mushy ice with a thin layer of snow on the top.

In band 4 and 5 the snow has its greatest extent and on band 6 and 7 pictures, the snow covered a somewhat smaller area.

When the scene was taken,the suns altitude was only 20 degrees. Because of this , in areas with strong topography this causes shaddoweffects like those SW of Mår-lake. In band 6 and 7 one do not see the difference between lakes and shaddows, however in band 4 it is easy to distinguish between the two.
One very good example of this is found in the Rondane mountains. A lake in Myldingdalsbotn is completely shaddowed by the more than 2100 meter high Storronden peak.

On the same scene one can see a thin layer of snow on the highest parts of several montains that is produced by only a few millimer of precipitation from the night before the ERTS imagery was recorded.

Johnny Skorve

Cooinvestigator

Oslo, February 1973